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EXTRACTION OF ROOTS BY LOGARITHMS.

BY ARTEMAS MARTIN, ERIE, PA.

LOGARITHMS would afford the readiest method of computing the roots of numbers if we had Tables of sufficient extent.

Let it be required to find the n^{th} root of a .

1. — Put $r + x = \sqrt[n]{a}$, then $\log r = \frac{1}{n} \log a$, and r is the number whose logarithm is $\frac{1}{n}$ of the logarithm of a . Common logarithms may be used in this case.

2. — Put $r + x = \sqrt[n]{a}$, where r is the integral part of the root; then, using Napierian logarithms,

$$\log (r + x) = \frac{1}{n} \log a.$$

Expanding $\log (r + x)$ and transposing $\log r$,

$$\left(\frac{x}{r}\right) - \frac{1}{2}\left(\frac{x}{r}\right)^2 + \frac{1}{3}\left(\frac{x}{r}\right)^3 - \frac{1}{4}\left(\frac{x}{r}\right)^4 + \&c. = \frac{1}{n} \log a - \log r \dots (1)$$

Reverting this series,

$$\begin{aligned} \frac{x}{r} = \left(\frac{1}{n} \log a - \log r\right) &+ \frac{\left(\frac{1}{n} \log a - \log r\right)^2}{1.2} + \frac{\left(\frac{1}{n} \log a - \log r\right)^3}{1.2.3} \\ &+ \frac{\left(\frac{1}{n} \log a - \log r\right)^4}{1.2.3.4} + \frac{\left(\frac{1}{n} \log a - \log r\right)^5}{1.2.3.4.5} + \&c \end{aligned}$$

Example. — Required the one-hundredth root of 2.

Put $a = 2$, $r = 1$ and $n = 100$; then

$$\begin{aligned} \sqrt[100]{2} = 1 + \frac{\log 2}{100} + \frac{(\log 2)^2}{1.2.(100)^2} + \frac{(\log 2)^3}{1.2.3.(100)^3} \\ + \frac{(\log 2)^4}{1.2.3.4.(100)^4} + \&c. \end{aligned}$$

The Napierian logarithm of 2 is 0.693147180559 +,

$$\therefore \sqrt[100]{2} = 1.0069555499 + .$$